Liner Structures

Related Application

This is a utility application claiming the priority of Provisional Applications Serial No. 60/182,634 filed February 15, 2000 and Serial No. 60/182,276 filed February 14, 2000, the entire contents of which are incorporated herein by reference.

Field of the Invention

This invention generally relates to structures suitable for use as non-adhesive, non-skid liners to cover and/or protect generally horizontal planar surfaces such as shelves, drawers, and the like and methods of making such structures.

Background of the Invention

Consumers use a wide variety of sheet materials in and around the home as an underlayment and lining material. Decorative papers have been used for many years to line shelves and drawers, for example. Some decorative papers are provided with an adhesive on one side to provide a more permanent lining. Plastic materials such as polyvinyl chloride have also been commonly provided in sheet form or as a reinforced composite, often with an adhesive coating on one side, for use by consumers as liners.

An alternative type of liner structure is described in U.S. Patent No. 4,947,999. Such structures include a sheet of plastic material having a substantially flat bottom side for lying on a subjacent surface of a shelf or drawer. An integral raised pattern of ridges project upwardly from a top side of the sheet. The tops of the ridges are generally coplanar and provide a reduced surface area for supporting articles such as glasses and tableware and for allowing air flow beneath the articles.

While liner structures of this type offer certain advantages over liners previously known in the field, still further improvements would be desirable. For example, a ribbed shelf liner product corresponding to the structures described in the aforementioned U.S. Pat. No. 4,947,999 is currently being marketed under the trademark "PLAST-O-MAT". This product is constructed of a relatively stiff and slippery plastic and has a tendency to curl when placed on a flat surface. Thus, it is difficult to keep the liner in a desired position on a smooth support surface due to its tendency to slide along the support surface when subjected to a force parallel to the plane of the liner such as the force generated by removing an article from the liner. This deficiency is acknowledged in U.S. Patent No. 4,947,999, which describes the liner structure as having a "semi-rigid" construction and suggests using double-faced tape to secure it in place.

Summary of the Invention

This invention provides a liner structure suitable for covering or protecting horizontal support structures such as shelves, said liner structure comprising a flexible sheet having a top surface and a bottom surface. The flexible sheet is non-rigid and is constructed of a first polymeric resin which is sufficiently soft to render the flexible sheet non-curling and the bottom surface non-skid. A plurality of upwardly extending ridges comprising a second polymeric resin which is harder than the first polymeric resin and which provides a low friction surface on the top edges of the upwardly extending ridges, are present on the top surface of the flexible sheet. In one embodiment of the invention, the bottom surface is not flat and comprises downwardly extending ridges constructed of a soft polymeric resin. The liner structures may be fabricated using a coextrusion process.

Brief Description of the Drawings

Fig. 1 is a partial top plan view of a liner of the invention.

Fig. 2 is a partial bottom plan view of the liner of Fig. 1.

Fig. 3 is a view in partial sections of the liner of Fig. 1 in the direction of arrows 3-3.

Fig. 4 is a view in section of the liner of Fig. 1 in the direction of arrows 4-4.

Fig. 5 is an end view of a second embodiment of the invention.

Fig. 6 is an end view of a third embodiment of the invention.

Fig. 7 is an end view of a fourth embodiment of the invention.

Detailed Description of the Invention

The liner structures described in U.S. Patent No. 4,947,999 (incorporated herein by reference in its entirety) may be improved by the use of at least two different polymeric resins in fabricating said structures. The bottom side of the liner structure which facially engages the support surface is constructed of a relatively soft polymeric resin. This resin is selected so as to render the bottom side of the liner structure non-skid in character. The term "non-skid" means inhibiting or hindering, but not preventing completely, slipping or sliding.

Thus, the bottom side should be non-adhesive, i.e., not fixed fastly to the support surface. The area of the bottom side which is in contact with the support surface should be effective to inhibit or hinder slipping or sliding of the liner structure tangentially, laterally, or in a plane parallel to the support surface. The use of tape or other adhesive to hold the liner structure in place on a smooth horizontal support surface thus is unnecessary. Due to the absence of an adhesive, the liner structure may be readily picked up from the support surface for reuse or replacement without damaging the support surface or leaving adhesive residues, which are often difficult to remove. The polymeric resin comprising the sheet or web portion of the liner

structure also is preferably selected to be sufficiently flexible that the liner structure conforms to the contours of the support surface when placed in contact with said support surface and remains in conformance for an extended period of time (i.e., does not exhibit a significant degree of curling). The use of rigid or semi-rigid polymeric resins thus should be avoided when fabricating the sheet or web portion of the liner structure.

The polymeric resins can be any polymeric resin with sufficient flexability to conform to the surface and is not harmful to the surface. Resins such as polyurethane, polyolefin, polyvinyl chloride, polyesters, polyamides and the like can be useful. The resin can be plasticized to provide the required hand, hardness, non-curl and non-skid properties or can be copolymers designed to provide the required properties.

In a preferred embodiment of the invention, the polymeric resin used in the sheet or web portion is comprised of polyvinyl chloride which contains an amount of plasticizer effective to render the web flexible and non-skid. Plasticized polyvinyl chloride resins are well known and are described, for example, in the chapter entitled "Vinyl Chloride Polymers" in the Encyclopedia of Polymer Science and Engineering, Second Edition, Supplement Volume, pp. 822-889 (1989).

An example of a commercial resin suitable for use in the flexible web of the present liner structure is APEX 3301-80NT resin (available from the Plastics Division of the Teknor Apex Company, Pawtucket, Rhode Island). This resin has a Shore A hardness (15 second reading) of 66/60, a specific gravity of 1.16, a tensile strength of 1500 lbs/sq. in., and an ultimate elongation of 450%. Generally the Shore A hardness (15 second reading) of the flexible sheet is from about 50 to about 75. However, the hardness is always lower than the hardness of the resin forming or capping the upwardly extending ridges. In an alternate embodiment, the flexable sheet can

comprise a foamed or unfoamed polymer containing isocyanate residues. The composition of the flexible polymer sheet is not critical as long as it is sufficiently flexible to conform to the surface, has sufficient strength at the thickness required, provides a surface which is not slippery and is compatible and bondable with the harder polymeric material on the upward extending ridges. The flexible polymer sheet can be plasticized or can be a copolymer formulated to have the required properties.

The flexible web in preferred embodiments of the invention is substantially continuous, i.e., it does not contain any holes, perforations or other openings. This feature renders the liner structure esthetically pleasing in appearance and allows the liner structure to be easily cleaned using a sponge or the like. The liner structure thus completely protects the support structure surface from dirt, dust, water, food particles and the like. Another advantage of the liner structures of the present invention is the "cushioned" effect imparted by the rubbery and relatively soft polymeric resin. This reduces the tendency of fragile items such as glasses and fine china to break, crack or chip when placed forcefully on a hard support surface such as a wood shelf.

In certain embodiments of the invention, the liner structure is substantially solid and substantially free of pockets and other voids of significant size. However, in other embodiments, the flexible sheet is foamed (e.g., microcellular) in character.

The bottom surface of the flexible sheet may be flat or substantially flat so that when the liner structure is placed on a planar surface such as a shelf, all or substantially all of said bottom surface is in direct contact with the planar surface. However, in a preferred embodiment of the invention, the bottom surface has means such as ridges extending downwardly and defining an integral raised pattern on the bottom side of the flexible sheet. The bottom edges of the

downwardly extending ridges preferably are coplanar to provide a level supporting "surface" or means. This arrangement of downwardly extending ridges provides a reduced, substantially horizontal surface area in contact with the planar surface. Air may thus flow underneath the liner structure, thereby discouraging moisture accumulation and the growth of mold and mildew.

The downwardly extending ridges may be incorporated as a plurality of parallel ridges which are straight or in a wave or zig zag pattern. In one embodiment of the invention, the downwardly extending ridges are underneath and parallel to the upwardly extending ridges. The bottom surface of the liner structure thus may have an undulating or "rippled" appearance. In an embodiment of the invention, the downwardly extending ridges may be formed from a polymeric resin which has a lower Shore A hardness than the flexible web.

In one embodiment of the invention, the flexible web is uniform in thickness, typically from about 0.1 mm to about 2 mm and preferably from about 0.2 mm to about 1 mm. In other embodiments, however, the thickness of the flexible sheet is varied, preferably in a regular manner or pattern. For example, the thickness of the flexible sheet may be relatively thin (e.g., about 0.1 to about 1 mm) inbetween the upwardly extending ridges and relatively thick (e.g., about 0.6 mm to about 3.0 mm) at the upwardly extending ridges. Varying the thickness of the flexible sheet may also be used to create the downwardly extending ridges.

The downwardly extending ridges should be constructed of one of the relatively soft polymeric resins previously described in connection with the sheet portion of the liner structure. In one embodiment of the invention, the same relatively soft polymeric resin is used in both the sheet and downwardly extending ridges since this will simplify the fabrication of the liner structure. It will generally be desirable for the downwardly extending ridges to be gently rounded or even flat to ensure that sufficient friction exists between the bottom edges of the

ridges and the surface on which the liner structure is supported to render the liner structure non-skid. In one embodiment, the downwardly extending ridges can be capped with a plastic which is softer than the flexible plastic from which the web is formed. A more skid resistent liner can be fabricated in this manner.

The means extending upwardly from the flexible sheet and defining an integral raised pattern on the top side of the flexible sheet are, on the other hand, comprised (at least on their top edges) of a harder polymeric resin than the polymeric resin used to form the bottom side of the flexible sheet. Said means may, for example, take the form of ridges. By using a harder polymeric resin, articles placed on the raised pattern may be readily removed from the liner structure even in a direction generally parallel to the plane of the liner structure since the coefficient of friction will be relatively low. This feature is particularly advantageous where the ridges have relatively thick top edges and thus have a relatively large surface area in contact with the bottom of an article placed on the linear structure. However, the polymeric resin used to fabricate such ridges should not be so rigid or inflexible that the ridges interfere with the ability of the liner structure to conform to the contour of the support surface. For the same reason, the harder polymeric resin is preferably not present in the areas between the upwardly extending ridges. If a relatively stiff polymeric resin is used to create the upwardly extending ridges, the cross-sectional area of the ridges may be reduced as needed in order to maintain the desired flexibility of the overall liner structure.

In a preferred embodiment of the invention, the polymeric resin used to form the upwardly extending ridges is compatible with, miscible with, or bonds with the polymeric resin used to fabricate the sheet portion so that good adhesion is developed directly between the ridges and the sheet portion. The use of a separately applied adhesive layer to join the ridges to the

sheet portion therefore is not necessary. The resulting liner structure is nevertheless highly resistant to delamination (separation of the ridges from the flexible sheet). The upwardly extending ridges (or at least the top edges thereof) in one desirable embodiment are comprised of a polyvinyl chloride resin. While this resin may be plasticized, the plasticizer level typically will be lower than the plasticizer level in the flexible sheet polymeric resin and sufficiently low so as to impart a low coefficient of friction to the exposed surfaces of the top edges of the upwardly extending ridges. The resin for forming or capping the upwardly extending ridges have a Shore A hardness (15 sec.) of from about 60 to about 100 and preferably from about 65 to about 90. The Shore A hardness of the resin for forming or capping the ridges has a higher Shore A hardness than the web or sheet portion.

Suitable polymeric resins for use in the upwardly extending ridges include POLYFLEX 118514 (available from Flex Technologies, Inc.) and APEX 3189 (available from the Plastics Division of the Teknor Apex Company). These PVC resins have the following characteristics:

	POLYFLEX 118514	APEX 3189
Shore A Hardness (15 sec. reading)	85	78/65
Specific Gravity	1.34	1.37
Tensile Strength (lbs./sq. in.)	3700	2950
Ultimate Elongation (%)	330	320

In one embodiment of the invention, the raised pattern is defined by a plurality of generally parallel ridges. The ridges may be straight or in the form of a wavy or zig-zag pattern or the like. The top edges of the ridges may be pointed, rounded or flat. Generally, a flat top edge is not preferred as air circulation will be restricted and articles placed on the liner structure may be somewhat more difficult to remove, particularly if the ridge is relatively wide, due to the

increase in the surface area of the ridge in contact with the bottom surface of the article. The top edges of the ridges should be coplanar to provide a level supporting "surface". In a preferred embodiment of the invention, the ridges are rounded with a width at their base in the range of from about 1 mm to about 4 mm and a height in the range from about 0.2 mm to about 3 mm (as measured from the centerline of the sheet or web at the point where the ridge is joined to the bottom web or sheet). It is not necessary for the upwardly extending ridges to be fabricated entirely from the relatively hard polymeric resin. The lower portion of each ridge, for example, may be comprised of the relatively soft polymeric resin with the relatively hard polymeric resin being used only as a thin cap on the top edge of the ridge. The spacing of the ridges may be adjusted as desired to provide effective support for articles placed on the liner structure. For example, the ridges should be sufficiently close together to prevent tall, relatively narrow articles such as glasses from tilting and falling over. Spacings in the range of from about 5 mm to about 15 mm and prefererably from about 7 mm to about 11 mm are effective for this purpose, for example.

The upwardly extending ridges not only impart a pleasing design texture to the liner structure, but also create channels into which excess water from glasses and dishes may readily drain and then evaporate. The liner structures of the present invention thus have a reduced tendency, as compared to previously known flat top liners, to develop water rings and the like.

A coextrusion process may be used to fabricate the liner structures of the present invention. In such a process, the relatively soft polymeric resin used to form the flexible sheet or web component is extruded simultaneously with multiple extrusions of the relatively hard polymeric resin used to form the plurality of upwardly extending ridges. The extruded melts are brought together in a common co-extrusion die having the desired cross-section of the liner

structure at elevated temperatures and pressures effective to form bonds at the interfaces between the two polymeric resins. The relatively hard polymeric resin thus is extruded through the die only at isolated points corresponding to the intended positions of the individual upwardly extending ridges.

While the polymeric resins used to construct the flexible sheet and the ridges may both be clear, dyed or similarly pigmented to provide a liner structure having a unitary appearance, the decorative appearance of the liner structure may also be easily varied as desired. For example, the web material and the ridge material may be pigmented in complementary or contrasting colors. The web material may be clear and colored and the ridge material may be pigmented and opaque. Alternatively, the web material may be unpigmented or clear and the ridge material colored.

The liner structures of the present invention may be fabricated to any suitable length and width. For example, where the liner is designed to be used on a household shelf of conventional width, the liner width may be adjusted accordingly (e.g., from about 250 mm to about 400 mm) by selection of a coextrusion die of the appropriate dimension. Alternatively, a wider coextrusion die may be used and the coextruded liner structure cut to the desired width by slitting or the like. Coextrusion permits a liner structure of essentially infinite length to be manufactured. To facilitate packaging and handling, however, the liner structure will generally be cut to a shorter suitable length (e.g., from about 0.9 meters to about 4 meters). The end user may readily cut the liner structure to fit the support structure using scissors, a razor knife or the like. In an alternate embodiment, the extrusion die can be as wide as the desired length of the liner and the extruded sheet can be cut across the width to provide a liner with the appropriate width. This method provides a liner with the ridges which extend across the width of the liner.

In the Figures, the same numerals are used to refer to similar parts of the liner.

Fig. 1 is a partial plan view of a liner 1 of the invention. Liner 1 comprises a flexible non-skid plastic web 3 which can be formed from a plasticized polymer if required. The liner 1 shows ridges 2 comprised of a plastic which has a higher Shore A hardness than the web. The valleys between the ridges are shown as 4.

Fig. 2 is a partial bottom plan view of the liner 1 of Fig. 1 showing the ridges 5 and valleys 6. The ridges 5 contact the surface on which the liner is laid.

Fig. 3 is a view along the arrows 3-3 in Fig. 1. The web 3 of liner 1 comprises a plastic which is flexible, lies flat and does not curl and provides non-skid contact with the surface on which it is laid. The ridges 2 are formed from a plastic with a higher Shore A hardness than the web 3. The top and bottom surfaces of the web have an undulating form with valleys and ridges. The ridges 2 are capped with a plastic which is harder than the plastic of web 3.

Fig. 4 is a sectional view in the direction of arrows 4-4 of Fig. 1. Fig. 4 shows liner 1 cut through the thin portion of web 3. The liner is supported by ridges 5 which permit air to flow between a supporting surface and the liner 1. The top surface comprises the valleys 4 and the capped ridges 2.

Fig. 5 is an end view of an embodiment of the invention where the liner 1 comprises a web 3 having ridges 2 with a triangular shaped profile. The upper surface 4 of web 3 is substantially flat with the upward extending ridges 2. The bottom surface of web 3 has an undulating cross-section with ridges 5 and valleys 6.

Fig 6 is an end view of a liner 1 comprising a substantially flat web 3 having ridges 2 formed from a harder plastic than the web, on the top surface. The ridges 2 are coextruded with the web 3. However, the ridges 2 can be formed separately and joined to the web 3 by fusing,

gluing and the like. The web 3 is flexible so that it lays flat on a surface. The ridges 2 are formed from a plastic which is harder than the plastic forming web 3.

Fig. 7 is an endview of a liner 1 in which the web 3 is in a corrugated form having ridges 2 and valleys 4 on the top surface and ridges 5 and valleys 6 on the bottom surface. The liner rests on the ridges 5 of the bottom surface. The ridges 5 coincide with the valleys 4 of the top surface. The ridges 2 are capped with a plastic which is harder than the plastic of the web 3, which capped ridges contact and support items on the top surface of web 3. In an alternate embodiment the ridges may be formed by means of the harder plastic which rises from the valleys 4 and protrudes above the top of the ridges 2.

The non-curl and non-skid liner of the present invention provides for easy installation and removal of the liner since no adhesive is required to maintain the liner in place.

The plastic or resin from which the web 3 of the liner 1 is made can be any plastic or resin which has the required flexibility, hardness and non-skid properties. The plastic or resin can be plasticized or unplasticized and can be foamed or non-foamed. Resins or plastics such as polyurethane, polyester, polyamide, polyolefin and polyvinyl chloride can be adapted to form the web either by selection of the monomers which form the plastic or resin or by addition of plasticizers which are well known in the art. The plastic for forming the web has a Shore A hardness (15 seconds) of from about 50 to about 75 and preferably from about 55-70.

The ridges of the top surface of the liner of the invention are formed from or capped with a plastic or resin which has a hardness greater than the hardness of the flexible plastic forming the web. The Shore A hardness (15 seconds) of the plastic or resin forming the ridges or caps for the ridges is from about 60 to about 100 and preferably from about 65 to about 90. The plastic resin which comprises the ridges on the top surface of the liner is preferably 3 and more

preferably at least 5 and most preferably at least 7 Shore A hardness units harder than the plastic or resin which forms the web of the liner.